56. where does normal line intersect the curve

(1,1) we want another point (x, y)

need 2 eqns. 1. $x^2+2xy-3y^2=0$

2. normal line $y=-(x-1)+1$

slope: ⊥

$2x+\underline{2xy'+y\cdot 2}-6yy'=0$

$2xy'-6yy'=-2x-2y$

$y'(2x-6y)=-2x-2y$

slope of tan

$y'=\left.\frac{-2x-2y}{2x-6y}\right|_{(1,1)}=\frac{-4}{-4}=1$

$m_\perp=-1$

solve$(x^2+2x\cdot y-3y^2=0, x) \mid y=-(x-1)+1$

$x=1$ $x=3$

$y=1$ $y=-1$

Oct 3-8:47 AM

57. find normals (eqn) that are

$\boxed{xy+2x-y=0}$

$\underline{\text{parallel}}$ to $2x+y=0$

same slope as ↑ $\boxed{m_\perp=-2}$

normal

need a pt. (x, y)

$\boxed{y'}$ $\boxed{m_{tan}=\frac{1}{2}}$

$\boxed{y'=\frac{1}{2}}$

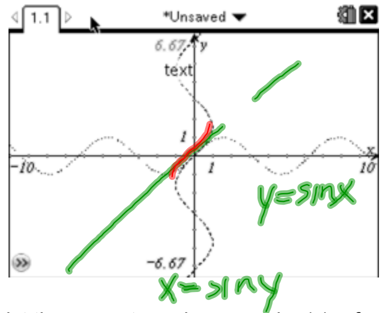
Oct 3-9:02 AM

3.8 Derivatives of inverse trig functions

Derivative of the Arcsine

$y=\sin^{-1}(x)$ *means* $x=\sin(y)$

$y=\arcsin(x)$



restrict the range to make y=arcsine(x) a function

$-\frac{\pi}{2}\le \sin^{-1}x \le \frac{\pi}{2}$

$$\boxed{\frac{d}{dx}\sin^{-1}x = \frac{1}{\sqrt{1-x^2}}}$$

$x=\sin y$

$1=y'\cos y$

$y'=\frac{1}{\cos y}$

$=\frac{1}{\sqrt{1-\sin^2 y}}$

$=\frac{1}{\sqrt{1-x^2}}$

$\sin^2 x+\cos^2 x=1$

$\cos x=\sqrt{1-\sin^2 x}$

Oct 4-6:55 PM

$\frac{d}{dx}\left(\sin^{-1}x^2\right)= 2x\cdot\frac{1}{\sqrt{1-(x^2)^2}}$

$u=x^2$

$$\boxed{\frac{d}{dx}\sin^{-1}u=\frac{1}{\sqrt{1-u^2}}\cdot\frac{du}{dx}}$$

$\frac{d}{dx}\left(\sin^{-1}\frac{\sqrt{x}}{3}\right)= \frac{1}{6}x^{-\frac{1}{2}}\cdot\frac{1}{\sqrt{1-\left(\frac{\sqrt{x}}{3}\right)^2}} = \frac{1}{6\sqrt{x}\sqrt{1-\frac{x}{9}}}$

$\frac{1}{3}\sqrt{x}$

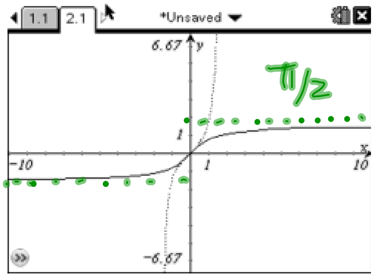
$\frac{1}{3}\cdot x^{\frac{1}{2}}$

Oct 4-7:09 PM

Derivative of the Arctangent

$$\boxed{\frac{d}{dx}\tan^{-1}u = \frac{1}{1+u^2}\frac{du}{dx}}$$

$-\frac{\pi}{2}$



What is the range of y=Arctan(x) ?

Oct 4-7:14 PM

A particle moves along the x-axis so that its positon at any time t>=0 is $x(t) = \tan^{-1}\sqrt{t}$ What is the velocity of the particle when t=16?

$$\left.\frac{dx}{dt}\right|_{t=16}$$

$$x = \tan^{-1}(t^{1/2})$$

$$\frac{dx}{dt} = \frac{1}{2}t^{-1/2}\cdot\frac{1}{1+(\sqrt{t})^2} = \frac{1}{2\sqrt{t}(1+t)}$$

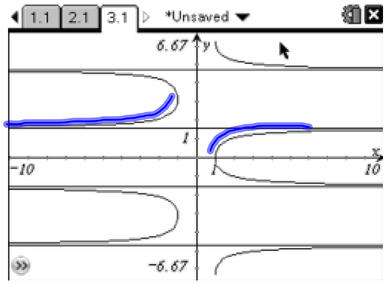
$$x'(16) = \frac{1}{2\cdot 4\cdot 17}$$

$$= \frac{1}{136}$$

Oct 4-7:24 PM

Derivative of the Arcsecant

$$\boxed{\frac{d}{dx}\sec^{-1}u = \frac{1}{|u|\sqrt{u^2-1}}\,\frac{du}{dx}}$$



restrict the range to make y=Arcsec(x) a function

$0 \le \sec^{-1}x \le \pi$

Oct 4-7:24 PM

$$\frac{d}{dx}\sec^{-1}(5x^4) = 20x^3 \cdot \frac{1}{|5x^4|\sqrt{(5x^4)^2-1}}$$

Oct 4-7:31 PM

Derivatives of the other three

$$\cos^{-1} x = \frac{\pi}{2} - \sin^{-1} x$$

$$\frac{d}{dx}\cos^{-1} x = \frac{-1}{\sqrt{1-x^2}}$$

$$\cot^{-1} x = \frac{\pi}{2} - \tan^{-1} x$$

$$\csc^{-1} x = \frac{\pi}{2} - \sec^{-1} x$$

Oct 4-7:34 PM

Derivative of an inverse function

If *f* and *g* are inverse functions then $\boxed{g'(x) = \frac{1}{f'(g(x))}}$

$$g'(x) = \frac{1}{f'(y)}$$

$$\{y = g(x)\}$$

Oct 4-7:38 PM